

Remarks

Claims 1, 2, 5, 26, 27, 33-35, and 62 have been amended; claims 6-25 and 36-60 are cancelled and claims 1-5, 26-35, and 61-67 are pending in the application. The amendments to the claims do not constitute new matter as they are supported by the specification at, for example, pages 7-21 and Figures 2-10 of the specification.

Reconsideration of the application in view of the amendments and the remarks to follow is requested.

Claims 1-5, 26-35, and 61-67 stand rejected under 35 U.S.C. 103(a) as being unpatentable in view of Chau (5,763,922), Buchanan et al (6,566,281), and Schindler et al (5,962,069) in various combinations.

The Examiner is respectfully referred to MPEP §2142, which recites, in pertinent part; to establish a prima facie case of obviousness the prior art reference (or references when combined) must teach or suggest all the claim limitations. Applicant requests reconsideration of these rejections for at least the reason that the cited references do not teach or suggest all the elements of the pending claims.

Referring first to the most recent Office Action of September 23, 2004, the Examiner correctly indicates that Chau does not disclose the activated nitrogen forming peak concentration of at least 15 atomic %. The Examiner relies on Buchanan for such teaching.

Buchanan describes a method that first includes the chemical vapor deposition of a nitrogen-rich layer that contains silicon and nitrogen, with the nitrogen having a peak concentration of approximately 25%. Buchanan also describes an alternative embodiment that includes the nitridation of this nitrogen-rich layer after it has been formed (see, e.g.,

column 5, lines 54-67; column 6, lines 1-11; column 7, lines 10-15; and column 8, lines 5-10 of Buchanan).

Claim 1 has been amended and, as amended, recites, in pertinent part, a method of forming a transistor device that includes exposing a substrate surface having a first peak nitrogen concentration to activated nitrogen to form an exposed surface having a second peak nitrogen concentration at least 15% (atom percent) greater than the first peak nitrogen concentration. The cited references do not teach or suggest these limitations.

As indicated by the Examiner, Chau does not teach or suggest the 15% peak nitrogen concentration. Likewise, Buchanan does not teach or suggest exposing a substrate surface having a first peak nitrogen concentration to activated nitrogen to form an exposed surface having a second peak nitrogen concentration at least 15% (atom percent) greater than the first peak nitrogen concentration.

Buchanan describes the nitridation of a surface having a peak nitrogen concentration of 25%, but fails to describe the amount of change of this peak nitrogen concentration upon this nitridation. Chau recites increasing a nitrogen concentration within a surface no higher than 5% by nitridation for at least some critical reasons the state of the art clarifies (see, e.g., U.S. Patent 6,436,845 to Kamath at Column 3, lines 15-25; and Column 4, lines 1-25). Buchanan describes no methods for increasing a nitrogen concentration within a surface by at least 15%. While a concentration of 25% nitrogen is recited by Buchanan, it is the concentration of a silicon nitride layer formed by CVD, not the increase in concentration of an exposed surface after being exposed to activated nitrogen.

According to at least one embodiment, the claimed invention is different from the prior art processes that have been utilized for forming dielectric materials to prevent dopant penetration because the combination of high power plasma generation of activated

nitrogen together with long duration exposure of a surface to the activated nitrogen forms an exposed surface which is suitable for reducing a dopant concentration of a Vt implant for a PMOS device. Prior art processing such as Chau, Kamath, and Buchanan did not utilize these techniques because these references were attempting to increase concentrations of a surface by no more than 5%. As such the cited references do not recite an exposed surface having a peak nitrogen concentration about 15% greater than the surface before exposure to activated nitrogen. For at least these reasons, the cited references do not teach or suggest all the elements of claim 1 and claim 1 is in condition for allowance.

Claims 2-5 depend from claim 1 and are allowable for at least the reasons cited above regarding claim 1.

Claim 26 has been amended and, as amended, recites a method of forming a transistor device that includes, in pertinent part, forming a dielectric material over a channel region with the forming of the dielectric material comprising exposing a substrate surface to activated nitrogen to increase a peak nitrogen concentration within the substrate surface by at least about 15 atom%. As discussed above, claim 26 is allowable for at least the reasons that the cited references do not teach or suggest exposing a substrate surface to activated nitrogen to increase a peak nitrogen concentration within the substrate surface by at least about 15 atom%.

Claims 27-35 depend from claim 26 and are allowable for at least the reasons cited above regarding claim 26.

Claim 61 recites a method of forming a plurality of transistor devices that includes a substrate having a surface with the substrate comprising silicon. Claim 61 also recites

incorporating at least 15 atom% nitrogen into the surface by exposing the surface to activated nitrogen.

As discussed above, the cited references do not teach or suggest incorporating at least 15 atom% nitrogen into the surface of a substrate by exposing the surface to activated nitrogen. For at least this reason claim 61 is allowable in view of the cited references.

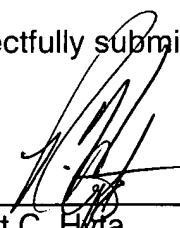
Claim 61 goes on to recite forming a pair of source/drain regions within the substrate with the pair of source/drain regions being separated from one another by a channel region with each of the source/drain regions comprising a heavily doped portion proximate the channel region and a lightly doped portion separated from the channel region by the heavily doped portion. For at least the reasons the cited references do not teach or suggest these features as well as the features of claim 61 discussed above, claim 61 is allowable.

Claims 62-67 depend from claim 61 and are allowable for at least the reasons cited above regarding claim 61.

Claims 1-5, 26-35 and 61-67 are believed to be in condition for allowance. Applicant requests allowance of these claims in the Examiner's next action.

Respectfully submitted,

Dated: 12/26/04

By: 
Robert C. Hyta
Reg. No. 46,791

-END OF DOCUMENT-